What is claimed is:

1. An apparatus for dissociating gases comprising:

a) a plasma chamber;

b) a transformer having a magnetic core surrounding a portion of the plasma chamber and a primary winding;

c) one or more switching semiconductor devices directly coupled to a voltage supply and having an output coupled to the primary winding,

the one or more switching semiconductor devices driving current in the primary winding, the current inducing a potential inside the chamber that forms a plasma which completes a secondary circuit of the transformer.

2. The apparatus of claim 1 wherein the voltage supply comprises a line voltage supply or a bus voltage supply.

3. The apparatus of claim 1 wherein the one or more switching semiconductor devices comprises one or more switching transistors.

4. The apparatus of claim 1 wherein the output of the one or more switching semiconductor devices is directly coupled to the primary winding.

5. The apparatus of claim 1 wherein the chamber comprises a metallic material.

6. The apparatus of claim 5 wherein the metallic material comprises aluminum.

7. The apparatus of claim 1 wherein the chamber comprises a dielectric material.

8. The apparatus of claim 1 further comprising an electrode positioned in the chamber that generates free charges which assist the ignition of a plasma in the chamber.

9. The apparatus of claim 1 further comprising an electrode capacitively coupled to the chamber that generates free charges which assist the ignition of a plasma in the chamber.

10. The apparatus of claim 1 further comprising an ultraviolet light source optically coupled to the chamber that generates free charges which assist the ignition of a plasma in the chamber.

11. The apparatus of claim 1 further comprising a circuit for measuring electrical parameters of the primary winding and the plasma, the electrical parameters including one or more of the current driving the primary winding, a voltage across the primary winding, a bus voltage, an average power in the primary winding, and a peak power in the primary winding.

12. The apparatus of claim 11 further comprising a power control circuit coupled to an output of the circuit for measuring electrical parameters of the primary winding and the plasma, the power control circuit determining the current flowing through the primary windings from a measurement of the electrical properties of the primary winding and of the plasma and from a predetermined set point representing a desired operating condition.

13. The apparatus of claim 1 further comprising a process chamber that is coupled to the plasma chamber and positioned to receive reactive gas generated by the plasma.

14. An apparatus for generating ions comprising:

a) a plasma chamber;

b) a transformer having a magnetic core surrounding a portion of the plasma chamber and a primary winding;

c) one or more switching semiconductor devices directly coupled to a voltage supply and having an output coupled to the primary winding,

the one or more switching semiconductor devices driving current in the primary winding, the current inducing a potential inside the chamber that forms a plasma which completes a secondary circuit of the transformer.

d) an orifice positioned in the chamber for directing ions generated by the plasma.

15. The apparatus of claim 14 wherein the voltage supply comprises a line voltage supply or a bus voltage supply.

16. The apparatus of claim 14 further comprising a process chamber that is coupled to the orifice in the plasma chamber and adapted to receive ions generated by the plasma.

17. The apparatus of claim 16 further comprising accelerating electrodes positioned in the process chamber for accelerating ions generated by the plasma.

18. The apparatus of claim 14 wherein the chamber comprises a refractory metal.

19. An apparatus for dissociating gases comprising:

a) a plasma chamber comprising an electrically conductive material and at least one dielectric region that prevents induced current flow in the chamber;

b) a transformer having a magnetic core surrounding a portion of the plasma chamber and a primary winding;

c) a power supply having an output electrically connected to the primary winding,

the power supply driving current in the primary winding, the current inducing a potential inside the chamber that forms a plasma which completes a secondary circuit of the transformer.

20. The apparatus of claim 19 wherein the chamber comprises a plurality of dielectric regions separating at least two regions of the plasma chamber.

21. The apparatus of claim 19 wherein the dielectric region comprises at least one of a dielectric spacer or a dielectric coating on at least one mating surface of the chamber.

22. The apparatus of claim 19 wherein the chamber comprises aluminum.

23. The apparatus of claim 19 wherein the chamber comprises cooling channels for passing a fluid that controls the temperature of the chamber.

24. The apparatus of claim 19 wherein the power supply comprises one or more switching semiconductor devices directly coupled to a voltage supply and having an output coupled to the primary winding.

25. The apparatus of claim 24 wherein the voltage supply comprises a line voltage supply or a bus voltage supply.

26. The apparatus of claim 19 further comprising an electrode positioned in the chamber that generates free charges which assist the ignition of a plasma in the chamber.

27. The apparatus of claim 19 further comprising an electrode capacitively coupled to the chamber that generates free charges which assist the ignition of a plasma in the chamber.

28. The apparatus of claim 19 further comprising an ultraviolet light source optically coupled to the chamber which assists the ignition of a plasma in the chamber.

29. A method for dissociating gases comprising:

a) providing a chamber for containing a gas at a pressure;

b) providing a transformer having a magnetic core surrounding a portion of the chamber and a primary winding;

c) directly coupling one or more switching semiconductor devices to a voltage supply and generating a current driving the primary winding with the one or more switching semiconductor devices; and

d) inducing a potential inside the chamber with the current in the primary winding, the potential forming a plasma which completes a secondary circuit of the transformer.

30. The method of claim 29 wherein the step of directly coupling one or more switching semiconductor devices to a voltage supply comprises directly coupling the one or more switching semiconductor devices to a line voltage supply or to a bus voltage supply.

31. The method of claim 29 further comprising the step of directly coupling the one or more switching semiconductor devices to the primary winding.

32. The method of claim 29 further comprising the step of providing an initial ionization event in the chamber.

33. The method of claim 32 wherein the step of providing an initial ionization event in the chamber comprises applying a voltage pulse to the primary winding.

34. The method of claim 32 wherein the step of providing an initial ionization event in the chamber comprises exposing the chamber to ultraviolet light.

35. The method of claim 29 wherein the gas comprises a noble gas.

36. The method of claim 29 wherein the gas comprises a reactive gas.

37. The method of claim 29 wherein the gas comprises a mixture of a reactive gas and a noble gas.

38. The method of claim 29 further comprising the step of measuring electrical parameters of the primary winding and of the plasma including one or more of the current driving the primary winding, a voltage across the primary winding, a bus voltage, an average power in the primary winding, and a peak power in the primary winding.

39. The method of claim 37 further comprising the step of determining an output of the one or more switching semiconductor devices from the measurement of the electrical parameters of the primary winding and of the plasma and from a predetermined set point representing a desired operating condition.

40. The method of claim 29 wherein the pressure is substantially between 1 mtorr and 100 torr.

41. The method of claim 29 wherein an electric field of the plasma is substantially between 1-100 V/cm.

42. A method for cleaning a process chamber comprising:

a) providing a plasma chamber for containing a reactive gas at a pressure, the plasma chamber being coupled to the process chamber;

b) providing a transformer having a magnetic core surrounding a portion of the plasma chamber and a primary winding;

c) directly coupling one or more switching semiconductor devices to a voltage supply and generating a current driving the primary winding with the one or more switching semiconductor devices;

d) inducing a potential inside the chamber with the current in the primary winding, the potential forming a plasma which completes a secondary circuit of the transformer; and

e) directing chemically active species generated in the plasma from the plasma chamber into the process chamber thereby cleaning the process chamber.

43. A method for generating reactive gases comprising:

a) providing a plasma chamber for containing a reactive gas at a pressure;

b) providing a transformer having a magnetic core surrounding a portion of the plasma chamber and a primary winding;

c) directly coupling one or more switching semiconductor devices to a voltage supply and generating a current driving the primary winding with the one or more switching semiconductor devices;

d) inducing a potential inside the chamber with the current in the primary winding, the potential forming a plasma which completes a secondary circuit of the transformer; and

e) generating reactive gas in the plasma.